“Music is my drug”: Alexithymia, empathy, and emotional responding to music

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Abstract

Like alcohol or other drugs, music is often enjoyed by humans for its mood-altering effects. However, there is substantial individual variation in emotional responding to music (ERM). The present study investigated potential roles of trait variables in ERM. Recruitment and testing of 205 adult regular music listeners was accomplished online. They were asked to complete the Geneva Emotional Music Scale (GEMS) retrospectively by rating the felt intensity of 45 music-related emotions based on what they typically experienced when listening to their favorite music. They also completed instruments assessing traits of alexithymia, affect intensity and empathy as well as the Big Five factors. Alexithymia, affect intensity and empathy, but not the Big Five, were moderately positively correlated with ERM as measured by GEMS. In a hierarchical regression, alexithymia and empathy were significant positive predictors of ERM after controlling for the other variables; extraversion was also significant in the final model. The role of empathy as a predictor of ERM was consistent with the emotional contagion interpretation of ERM. The unexpected positive relationship of alexithymia with ERM suggests that alexithymic listeners may rely on music to help them experience emotions more fully. Limitations and potential implications of the findings are discussed.

Keywords: personality; individual differences; emotion; alcohol; self-regulation

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Listening to music is a common means of manipulating emotional feelings (Allen, Hill, & Heaton 2009; Juslin, Harmat & Eerola, 2014; Juslin & Laukka, 2004; Sloboda & O'Neill, 2001). The physiological reactions that occur in response to music engagement have been likened to the reward system activation induced by psychoactive drugs (Blood & Zatorre, 2001; Chanda & Levitin, 2013; Mallik, Chanda & Levitin, 2017), and like alcohol or other drugs, music can alleviate psychological discomfort (Dingle & Fay, 2016; Pearce & Halpern, 2015). Although physiological responses to rhythm have been identified as a universal human experience (Zentner, Grandjean, & Scherer, 2008), emotional responses to music do not occur in such a uniform way across individuals. Self-report as well as physiological indices of music-induced emotions indicate that individuals differ in the frequency and intensity of emotions experienced during music listening (Baltes & Miu, 2014; Juslin & Laukka, 2004; Lundqvist, Carlsson, Hilmersson & Juslin, 2009; Zentner & Eerola, 2009).

Scherer and Zentner (2001) proposed four key mechanisms accounting for individual differences in emotional responding to music (ERM): the structure of the music, the performer's interpretation, contextual factors (such as location and modes of listening), and characteristics of the listener. Although influences of musical structure, performance and context have received increasing research attention, there has been less focus on personality traits as sources of variation in ERM (Liljeström, Juslin & Västfjäll, 2013). The present study used theory to infer potential roles of specific trait dimensions as influences on ERM, in addition to assessing broader factors including the so-called Big Five (McCrae & Costa, 1987).

One theoretical approach to interpreting ERM invokes emotional contagion, whereby listeners first perceive and then internally mimic and experience the emotions they understand the music to represent (Juslin et al., 2014; Lundqvist et al., 2009; Scherer & Zentner, 2001). A

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distinction can be made between perceiving emotional representations in music (e.g., music as a representation of romantic love, such as the *Liebestod* of Wagner's opera Tristan and Isolde), and reacting with an emotional response (e.g., re-experiencing feelings for a past lover). The experiences of musical emotions have been examined via multiple modes of measurement, most commonly self-report indices (Juslin & Laukka, 2004; Lundqvist et al., 2009; Zentner et al., 2008), but also measures of 'chills' (Baltes & Miu, 2014; Nusbaum & Silvia, 2010; Rickard, 2004) as well as emotion-related changes in heart rate, blood pressure, skin conductance and body temperature (Eerola & Vouskoski, 2011ab; Juslin et al., 2014; Juslin & Vastfjall, 2008; Zentner et al., 2008). For example, Lundqvist and colleagues (2009) reported emotion-consistent changes on a range of physiological measures of ERM, including changes in facial expression, heart rate, skin conductance and finger temperature.

In the current study ERM was defined as any emotion reported by an individual as occurring when they listen to their preferred music and that they perceive as induced or facilitated by their listening experience. Previous assessments of ERM have been based on basic emotions such as happiness, sadness, anger and fear, or a dimensional model which defined emotions by valence and arousal. Both approaches have been criticized for their failure to account for more complex music-induced emotions, with subsequent studies modifying self-report scales to match specific musical genres and encompass complex emotions such as nostalgia and transcendence (Eerola & Vuoskoski, 2011ab). Zentner and colleagues (2008) developed a new measurement tool assessing ERM, the Geneva Emotional Music Scale (GEMS). The GEMS is completed by rating felt intensity of 45 emotions induced by music, and was used in the present study to retrospectively measure participants' ERM as typically felt when listening to their favorite music.

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Unsurprisingly, the age of the listener has been found to influence music engagement, choice of genre and purpose for listening (Papinczak et al., 2015; Pearce & Halpern, 2015; Saarikallio & Erkkila, 2007). Adolescents often use music for mood enhancement, with music listening a preferred leisure activity (Dingle & Fay, 2016). Younger adults tend to report stronger ERM compared to older adults (Gabrielsson & Wik, 2003). For example, younger adults reported more intense positive emotions than older adults to uplifting film music, and more intense negative emotions to film music depicting tragedy or loss (Pearce & Halpern, 2015). Adolescents and young adults are also more likely to use music to change their emotions, perhaps reflecting the emotional dysregulation of that stage of life (Dingle & Fay, 2016; Papinczak et. al, 2015; Pearce & Halpern, 2015; Saarikallio & Erkkila, 2007). For these reasons, participant age was a necessary covariate in the present study, as was gender, which has been reported to show differences on some of the personality traits assessed.

Several personality variables were examined in the present study for their potential contribution to variance in ERM. The Big Five factors of extraversion, agreeableness, conscientiousness, emotional stability and openness were examined, primarily as covariates to help isolate the predicted roles of more specific traits that were hypothesized to have stronger influences on ERM. Of the Big Five, openness and extraversion have been found to predict enjoyment of a wide variety of music genres, as well as the tendency to listen to music for mood enhancement and relaxation (Liljeström et al., 2013; Nusbaum & Silvia, 2010; Rickard, 2004; Silvia & Nusbaum, 2011). Other research indicated that neuroticism (low stability) was associated with use of music for mood regulation (Chamorro-Premuzic & Furnham, 2007). However, none of those studies investigated the relationship between the Big Five and more sophisticated indices of ERM such as the GEMS, hence the current study included a brief but

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statistically valid index of the Big Five to assess their potential influences.

A likely influence on ERM is the subjective intensity of felt emotions in general. The Affect Intensity Measure (AIM; Larsen, 1984; Larsen, Diener & Emmons, 1986) was designed to capture individual differences in typical intensity of felt emotions, and was thus included in the present study. Although the AIM has not to our knowledge been used in previous research on ERM, a reasonable prediction was that stronger felt emotional responses in general should be associated with stronger ERM; hence the AIM was expected to show a significant positive relationship with the GEMS.

Another trait dimension that is in part defined by subjective appraisal of felt emotion (or lack thereof) is alexithymia, a personality construct characterized by difficulties in identifying and describing emotions as well as externally oriented thinking (Taylor & Bagby, 2000). Alexithymia has been linked to a range of psychopathologies including depression, anxiety, eating disorders, post-traumatic stress, substance use disorders (SUD) and autism spectrum disorder (ASD; Taylor, Bagby & Parker,1997; Taylor & Bagby, 2004; Thorberg, Young, Sullivan & Lyvers, 2009; Trevisan, Bowering & Birmingham, 2016). In nonclinical samples alexithymia is associated with heavier use of a variety of drugs including alcohol, cannabis, and caffeine (Lyvers, Duric & Thorberg, 2014; Lyvers, Jamieson & Thorberg, 2013). Use of alcohol to cope with negative moods, but also in the expectation that the drug will release or enhance emotions via disinhibition, may explain the association of risky drinking with alexithymia (Lyvers, Coundouris, Edwards & Thorberg, 2018; Thorberg et al., 2016). Use of music to relax, escape everyday reality, experience positive emotions and alleviate negative states (Ferrer, 2007) may seem superficially similar to drug use in terms of commonly expressed motives (Boys, Marsden & Strang, 2001). Alexithymic individuals may thus learn to use music for mood change

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purposes, just as those with alcohol dependence who are alexithymic report stronger alcohol expectancies of affective change than alcohol-dependent individuals without alexithymia (Thorberg et al., 2016). On the other hand, alexithymia has been linked to deficits on a range of tasks requiring emotional awareness, such as emotional empathy and facial emotion recognition (Lyvers, Kohlsdorf, Edwards & Thorberg, 2017; Lyvers, McCann, Coundouris, Edwards & Thorberg, 2018). Based on such considerations, alexithymic individuals should be restricted in their ability to experience and/or self-report emotions induced by music. However, findings to date have been unclear.

A few studies have examined the relationship of alexithymia to ERM in clinical samples. Allen and colleagues (2012) reported that in ASD, impaired ability to self-report ERM reflected high levels of alexithymia; by contrast, physiological indices of music-induced emotional arousal did not vary with alexithymia in their sample. Allen, Walsh and Zangwill (2013) concluded that ERM occurs in ASD but alexithymia causes difficulties with verbal labelling of such feelings, a conclusion consistent with electrophysiological findings (Goerlich, Witteman, Aleman, & Martens, 2011). Other work has indicated that music perception is spared or even enhanced in ASD (Heaton, 2009), and that characteristic deficits in detecting emotions from social cues and vocalizations (Heaton et al., 2012) may not extend to detecting emotions in music (Heaton et al., 2008; Heaton, Hermelin & Pring, 1999). A study of motivation to engage with music in ASD found that, similar to neurotypically developing individuals, 75% of those with ASD indicated that their primary use of music was for its effects on mood (Allen, Hill et al., 2009). Note however that ERM has previously been examined in relation to alexithymia in disorders such as ASD or depression, which may not generalize to alexithymia in the normal population (Allen, Davis & Hill, 2012; Punkanen, Eerola & Erkkilä, 2011).

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Another limitation of past research on ERM concerns a lack of consistency of musical stimuli, which have varied in genre as well as listening mode. A crucial factor in ERM is individual music preference (Juslin et al., 2008; Sloboda, O'Neil & Ivaldi, 2001). A typical music enthusiast is presumably more likely to emotionally respond to music if they have freely chosen the music themselves, rather than being presented with music from a less liked or unfamiliar genre. Hence, in previous studies the use of musical stimuli (most commonly classical or film music) without consideration of participants' music preferences may not generalize to ERM during freely chosen music listening. Even those with alexithymia may not be restricted in ERM to music they choose to listen to. Thus in the present study participants rated ERM for music they typically select for listening, rather than music selected by others.

As evidenced by the high comorbidity between alexithymia and substance misuse (Lyvers, Hinton et al., 2014; Thorberg et al., 2009), those with alexithymia appear to rely on external means to regulate mood due to their poor emotional self-regulation and coping skills (Stasiewicz et al., 2012). For example, alcohol may be used by alexithymic individuals to help them experience emotions through disinhibition, as well as alleviate negative states (Thorberg et al., 2016). Considering that one of the primary uses of music is for its effects on mood, there may be parallel motives for the use of drugs and the use of music in the context of alexithymia. Music and drugs often appear to go together, from Berlioz's use of opium to the use of MDMA at modern-day music festivals. Nevertheless, given the novelty of the current study – i.e., using the GEMS as an index of felt ERM in relation to alexithymia in a nonclinical sample - we tentatively predicted that alexithymia would be associated with weaker ERM given the general emotional deficits that define this personality trait.

Another trait defined by emotional awareness is empathy, which seems to have a clearer

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relationship to ERM. Those with greater ability to understand and respond to the perceived emotions of others should be more susceptible to emotional contagion (Baltes & Miu, 2014; Miu & Baltes, 2012; Scherer & Zentner, 2001) and therefore report stronger ERM (Vuoskoski, Thompson, Mcliwain & Eerola, 2012). Emotional contagion often occurs through observation of others and may involve activation of mirror neurons (Koelsch et al., 2006; Rizzolatti & Craighero, 2004). Emotionally arousing stimuli such as emotional facial expressions or tone of voice can induce emotional contagion, which has been invoked as a key (though not exclusive) mechanism of ERM (Juslin, 2000, 2001; Juslin et al., 2014; Juslin & Vastfjall, 2008). Juslin and colleagues have proposed that music acts as a super-expressive emotional voice that is unconsciously internalized during music listening, thereby inducing ERM. The role of trait empathy in music-induced emotional contagion is supported by evidence that empathy significantly increased ERM - as measured by both self-report and physiological indices – in 56 adults listening to a live opera performance (Baltes, Avram, Miclea & Miu, 2011). Similar findings in a larger follow up study further supported empathy as a key trait promoting ERM as measured by the GEMS (Baltes & Miu, 2014); however, whether this relationship extends to purely auditory experiences of music, where the visual, dramatic and contextual features of a live opera performance are absent, is unclear. According to Juslin (2001) musical sounds can represent emotions through qualities of tone alone, thus more empathetic individuals should be expected to be more emotionally responsive to music even when not presented in a live opera context. Private listening experiences such as playing music on a CD or car radio are of course very common. Based on this reasoning, trait empathy was expected to be a positive predictor of ERM.

The primary aim of the current study was to investigate individual differences in

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relation to ERM, with a particular focus on traits of alexithymia, affect intensity and empathy within the normal population. Demographic factors of age and gender, and the broad personality factors of the Big Five, were also examined as covariates. To account for diverse music preferences and sociocultural milieu, participants were asked to respond to the GEMS according to how the music they prefer to listen to typically makes them feel. As the GEMS uses Likert-type rating scales, responses were expected to reflect intensity of ERM across a wide range of complex music-related emotions.

Method

Participants

Recruitment was accomplished via the online survey site Qualtrics. Participants were required to be regular music listeners aged between 18 and 45 years. Those who indicated high levels of weekly alcohol consumption (i.e., 20 or more standard drinks per week), and those who were regular drug users (i.e., used illicit drugs at least once a month), were not eligible for participation due to the potential effects of intoxication on ERM. Of 233 volunteers who met inclusion criteria, 23 cases were removed for failing to complete the online questionnaires and 5 cases were removed as multivariate outliers (Mahalanobis distance $p < .001$). The final sample thus consisted of 205 male and female participants. Demographic information for the current sample is presented in Table 1.

Materials

The following instruments were administered online.

Screening/Demographics. Screening questions were used to identify individuals who were uncommitted to providing honest responses; those who consumed more than 20 drinks per week; those who consumed illicit drugs once per month or more; and those with a limited

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interest in music. The questionnaire also gathered information regarding age, gender, nationality, occupation, education, preferred musical genre and listening habits. Responses included filling in blanks or selecting the appropriate answer from a list of options. There were also two questions asking participants how often the music they typically listen to evokes emotions felt within themselves, and the intensity of the felt emotions that typically occur, on a scale of 1 (*very weak*) to 10 (*very strong*). However, the primary instrument in this regard was the GEMS.

Geneva Emotional Music Scale (GEMS). To retrospectively assess participants' ERM when listening to their favorite music, they were administered the GEMS, a questionnaire based on the domain-specific model developed by Zentner and colleagues (2008). Using a five-point Likert scale ranging from 1 (*Not at all)* to 5 (*very much),* respondents were asked to rate each of 45 emotion labels (e.g., *moved, energetic, joyful, nostalgic*) that were found to reliably describe emotions experienced during music listening. Factor analysis conducted by the GEMS authors supported nine emotion subscales that could be further organized into three factors: (1) Sublimity, consisting of wonder, transcendence, nostalgia and peacefulness (α = .92 in the present sample), (2) Vitality, consisting of power and joyful activation (α = .87 in the present sample), and (3) Unease, consisting of sadness and tension (α = .88 in the present sample). This factor structure was further supported by subsequent work (Baltes & Miu , 2014; Trost, Ethofer, Zentner & Vuilleumier, 2012). A global GEMS score can be used as an indicator of general ERM, calculated as a mean score of the 45 items, which showed high reliability (α = .95) in the current study. The two questions in the demographics/screening questionnaire that asked for ratings of frequency and intensity of ERM showed the expected highly significant positive correlations with total GEMS score ($p < .0001$). Although the GEMS is relatively new, it has been cited in over 540 research papers since its release (Coutinho & Scherer, 2016).

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Interpersonal Reactivity Index (IRI). The IRI is a widely used index of trait empathy (Davis, 1980, 1983). The scale has 28 items divided into four subscales of seven items each, rated on a five-point Likert scale ranging from 0 (*Does not describe me well*) to 4 (*Describes me very well*): Perspective Taking, e.g., "I believe there are two sides to every question and try to look at them both;" Fantasized Thinking, e.g., "I really get involved with the feelings of the characters in a novel;" Empathic Concern, e.g., "I often have tender, concerned feelings for people less fortunate than me;" and Personal Distress, e.g., "I tend to lose control during emergencies." The present study used the total IRI as a global index of empathy, which can range from 0 to 112 with higher scores indicating greater empathy. In the present sample the reliability index for the total IRI was α = .82.

Ten Item Personality Inventory (TIPI). The Big Five personality factors were measured using the TIPI (Gosling, Rentfrow & Swann, 2003). Participants were asked to rate the extent to which pairs of traits applied to them (e.g., Anxious, Easily Upset) on a seven-point Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*), with each factor calculated as an average of the two corresponding items. Construct validity of the TIPI has been supported by substantial positive correlations with the Big Five Inventory (Gosling et al., 2003). The TIPI is thus a brief but psychometrically sound indicator of the Big Five factors, which were primarily assessed as covariates in the present study.

Toronto Alexithymia Scale (TAS-20). The TAS-20 is a 20-item scale (Bagby, Parker, & Taylor, 1994) designed to measure alexithymia across three dimensions: Difficulty Identifying Feelings (DIF; e.g., "I have feelings that I can't quite identify"), Difficulty Describing Feelings (DDF; e.g., "I am able to describe my feelings easily," reverse scored), and Externally Oriented Thinking (EOT; e.g., "I find examination of my feelings useful in solving personal problems,"

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reverse scored). Responses are given on a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Total scores can range from 20 to 100 with higher scores indicating higher alexithymia. Bagby et al. (1994) provided cut-offs to identify individuals with definite or high alexithymia (total score ≥ 61) versus low or no alexithymia (total score ≤ 51), with scores in between considered borderline. The TAS-20 was treated as a continuous measure in the present study and had a reliability index of α = .88.

Affect Intensity Measure (AIM; short version). The brief version of Larsen's (1984; Larsen et al., 1986) AIM is a 20-item scale designed to measure individual differences in intensity of emotional response (Geuens & DePelsmacker, 2002). Participants respond to statements such as "I get really happy or really unhappy" on a six-point Likert scale ranging from 1 (*Never)* to 6 (*Almost Always).* Total scores can range from 20 to 120, with higher scores indicating more intense felt emotions. The original and the brief 20-item AIM were very highly correlated, thus the shortened version is a valid index of affect intensity (Geuens & DePelsmacker, 2002). Cronbach's reliability index in the present study was α = .69.

Procedure

Prior to data collection, approval was granted by the university human research ethics committee. The questionnaire battery was administered online by Qualtrics, promoted as a study investigating the relationship between personality traits and music appreciation. Participants completed the survey electronically via their own personal device at a time convenient for them. They were first provided with an explanatory statement outlining the purpose of the study, the expected completion time of 25 minutes and contact details of the researchers. Participants were also informed of the anonymity of their responses as well as their right to withdraw from the study at any time. Informed consent was indicated by a checked box response. Screening

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questions were then presented, with participants who failed to satisfy the criteria automatically taken to the end of the survey. Following completion of screening questions, those who were not excluded were prompted to complete the questionnaire battery. A response was required for every item in order to continue to the next. On completion of the questionnaires, participants were thanked for their time and offered a points-based incentive by the survey company.

Results

In the current sample there was no gender difference on alexithymia as indexed by TAS-20, $F < 1$, nor was there an overall gender difference on ERM as indexed by total GEMS, $F < 1$. Table 2 shows bivariate correlations among continuous variables. Age was negatively correlated with ERM (total GEMS as well as all three GEMS sub-factors), alexithymia (TAS-20), and affect intensity (AIM), but was positively correlated with TIPI indices of agreeableness, conscientiousness and emotional stability. ERM was positively correlated with the IRI index of empathy as well as affect intensity and – opposite to predictions – alexithymia, but showed only weak or no correlation with the Big Five personality traits as indexed by TIPI. Alexithymia was not only positively correlated with total ERM, but also with sublimity and unease sub-factors of the GEMS, whereas affect intensity and empathy were positively correlated with each other and with sublimity and vitality, but not unease.

Hierarchical linear regression assessed the contributions of trait variables to ERM as indexed by total GEMS scores. Age and gender were entered at step 1, the Big Five factors at step 2, affect intensity at step 3, empathy at step 4, and alexithymia at step 5. Step 1 was significant, $F(2, 202) = 13.74$, $p < .0001$, accounting for 12% of variance, with age a significant negative predictor. The entry of the Big Five at step 2 explained an additional 3% of variance but was not significant, $F change\ (5, 197) = 1.41$, $p = .22$; however the model remained significant,

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$F(7, 197) = 4.98$, $p < .0001$. Entry of affect intensity at step 3 accounted for an additional 3% of variance and was significant, *Fchange* (1, 196) = 6.41, $p = .01$. The overall model remained significant, $F(8, 196) = 5.27$, $p < .0001$, with affect intensity, extraversion, age and gender as significant predictors. Entry of empathy at step 4 explained an additional 8.6% of variance and was significant, *Fchange* (1, 195) = 22.70, $p < .0001$. The overall model remained significant, $F(9, 195) = 7.73$, $p < .0001$, with empathy, extraversion, age, and gender as significant predictors. Finally, entry of alexithymia at step 5 accounted for another 3% of variance and was significant, *Fchange* (1, 194) = 9.10, $p = .003$. The final model was significant, $F(10, 194) = 8.16$, $p < .0001$, accounting for 30% of variance in felt ERM, with alexithymia, empathy, extraversion, age and gender (indicating lower ERM for females) as significant predictors. Empathy was the strongest predictor among the personality variables, followed by alexithymia and then extraversion (see Table 3). Contrary to expectations based on the notion that, as alexithymia refers to restricted awareness of emotional feelings this should extend to low self-reported ERM, alexithymia was a positive predictor of ERM (as illustrated in Figure 1), as were empathy and extraversion.

The surprising result that alexithymia was positively associated with ERM suggested that perhaps personal music preferences varied with alexithymia. If alexithymic listeners tend to choose more or differently emotionally evocative music than those with low or no alexithymia, that might account for the unexpected positive relationship. An exploratory analysis was thus conducted to examine this. Preferred style of music was coded into the categories defined by the Short Test of Music Preferences (STOMP; Rentfrow & Gosling, 2003), such that classical, jazz, blues and folk were categorized as “reflective and complex,” rock and heavy metal as “intense

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and rebellious," pop, religious music and movie soundtracks as "upbeat conventional," and soul, funk and electronic music as "energetic and rhythmic." Comparison of music preference groups on alexithymia scores revealed no group differences, $F(4, 198) = 1.57$, $p = .18$.

Discussion

The present study recruited regular music listeners as participants, with 95% of the sample reporting that they typically listened to music more than once per week, and nearly half reporting daily listening. Further, 70% reported that they generally used music to induce an emotional change such as pleasure, relaxation or mood enhancement, with some of the remaining responses in the "other" category also consistent with such usage (e.g., "to relieve boredom"). Heavy drinkers and regular users of illicit drugs were excluded to avoid potential confounding influences of intoxication on ERM or participants' recollections thereof. This sample yielded both expected and unexpected findings.

Among the expected results were negative relationships between age and ERM, and positive relationships of empathy and affect intensity with ERM. The strong positive correlation between the latter two traits meant that entry of empathy into the regression model after affect intensity was the likely reason affect intensity was no longer significant in the final model. Contrary to predictions, alexithymia was significantly positively correlated with ERM and was a significant positive predictor of ERM even after controlling for all other study variables. This unexpected result was especially surprising given that groups defined by their music preferences based on the STOMP classifications (Rentfrow & Gosling, 2003) did not differ on alexithymia, so the possibility of differing musical choices by those with alexithymia was tentatively ruled out as a possible explanation.

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As alexithymia is defined by difficulties identifying and describing emotions as well as externally oriented thinking, we tentatively predicted that alexithymia would be associated with blunted ERM. Finding the opposite was thus a surprising result that invites explanation. One possibility is that, consistent with the hypoarousal model of alexithymia (Neumann, Sollers, Thayer & Waldstein, 2004), those with high levels of this trait may require an external arousing stimulus of some sort to allow full emotional awareness to occur. Consistent with that view, a previous study found that alexithymic university students reported consuming nearly twice as much per day of the stimulant drug caffeine as their low or non-alexithymic peers (Lyvers, Duric & Thorberg, 2014). However, the present relationship between alexithymia and ERM could not be reduced to simply arousal, as alexithymia scores showed no relationship with the Vitality (power, activation) sub-factor of the GEMS. Vitality is far more congruent with an arousing stimulus than the other two sub-factors, Sublimity and Unease, both of which were significantly positively associated with alexithymia. An alternative interpretation is that, as in the study by Thorberg et al. (2016) where expectation of intensified emotions (including negative emotions, paralleling results for the Unease factor in the present study) mediated the link between alexithymia and alcohol dependence, perhaps music enthusiasts with alexithymia experience a form of disinhibition or release of emotions through music. In other words, music may be used by alexithymic individuals in a similar manner to their use of alcohol. Perhaps music has drug-like properties in this regard, as reflected in a response to one of the open-ended questions of the present study as to why they listen to music: "*music is my drug*."

Though the AIM index of typical intensity of felt emotions was negatively related to alexithymia in the present study as expected, it was also positively related to ERM

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consistent with expectations based on the reasoning that stronger emotional responding in general should extend to ERM. However, reflecting the strong positive association between affect intensity and empathy in the present study, affect intensity was no longer significant following entry of empathy into the regression model. The role of empathy as a positive predictor of ERM was consistent with the interpretation of ERM as a form of emotional contagion due to music acting as a super-expressive emotional voice (Juslin, 2000; Juslin & Vastfjall, 2008). The role of age as an independent, negative predictor of ERM may reflect cohort effects related to music preferences, and/or age-related improvement in emotional self-regulation; consistent with the latter interpretation, both affect intensity and alexithymia were also negatively correlated with age.

Limitations of the present study necessarily include those associated with cross-sectional, self-report data. ERM to participants' favorite music was assessed retrospectively via the GEMS. Despite the potential for biases or distortions of memory, this approach had an advantage over previous work that administered music to participants such that, in the present study, participants rated ERM for their own preferred music rather than music selected and presented by researchers. The present cross-sectional design had the usual inherent limitations with respect to inferring causal relationships among variables; however, the present study was not intended to establish causation, but only to assess associations of specific trait variables with ERM. How and why certain personality traits are positively or negatively related to ERM are issues for future work, with the use of brain imaging a particularly interesting approach to the study of mechanisms of ERM (e.g., Koelsch et al., 2006; Trost et al., 2012).

Further research on factors contributing to ERM appears warranted, especially given the increasing incorporation of music-based therapies. Present findings suggest that alexithymic

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music listeners may use music in a similar way to alcohol, i.e., as a form of 'self-medication" and/or to induce or release emotions - including negative emotions. Given the common presentation of high alexithymia in clinical samples, music may offer such clients a reliable means to help them cope with negative states and/or to experience emotions more fully, instead of relying on the use of alcohol or other drugs for such purposes.

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Table 1. *Sample characteristics (N = 205)*

Variable		*n*	%
Gender	Female	136	66.3
	Male	69	33.7
Age	18 – 29 years	93	45.4
	30 – 45 years	112	54.6
Ethnicity	Aboriginal/Torres Strait Islander	4	2
	African	3	1.5
	Caucasian/European	176	85.9
	East/Southeast Asia	18	8.8
	Other	4	2
Education	Before Grade 12	14	6.8
	Grade 12	46	22.4
	Undergraduate/TAFE	119	58
	Postgraduate/PHD	26	12.7
Student Status	Yes	55	26.8
	No	150	73.2
Preferred genre of music (STOMP categories; see text)	Reflective and Complex	16	7.9
	Intense and Rebellious	36	17.7
	Upbeat and Conventional	94	46.3
	Energetic and rhythmic	27	13.3
	Mixed	30	14.8
Frequency of music listening	Every day, sometimes multiple times a day	91	44.4
	Almost every day	81	39.5
	Two to three times a week	23	11.2
	At most, once a week	10	4.9
Reasons for Listening	Mood modulation/manipulation/ enhancement	30	14.6
	Relaxation	23	11.2
	Pleasure/Enjoyment	91	44.4
	Other e.g., boredom	61	29.8

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Table 2

Intercorrelations of Variables (N=205)

Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1. Age	-											
2. ERM	-.33***	-										
3. Sublimity	-.29***	.96***	-									
4. Vitality	-.30***	.87***	.77***	-								
5. Unease	-.28***	.66***	.51***	.44***	-							
6. Alexithymia	-.24**	.21**	.15*	.10	.37***	-						
7. Empathy	-.08	.31***	.35***	.32***	.01	-.03	-					
8. Affect-Int	-.17*	.25***	.30***	.23**	-.03	-.11	.51***	-				
9. TIPI-E	-.01	.11	.12	.12	.02	-.22**	-.21**	.24**	-			
10. TIPI-A	.18*	-.01	.07	-.05	-.21**	-.34***	.39***	.15*	-.19**	-		
11. TIPI-C	.26***	-.15*	-.10	-.11	-.26***	-.39***	-.06	-.06	.03	.22**	-	
12. TIPI-ES	.21**	-.09	-.05	-.05	-.20**	-.36***	-.23**	-.22**	.27***	.25***	.30***	-
13. TIPI-O	-.07	.05	.12	.07	-.18**	-.40***	.19**	.34***	.24**	.24***	.29***	.03

Note. ERM = emotional responding to music; Affect-Int = affect intensity; TIPI-E = extraversion; TIPI-A = agreeableness; TIPI-C = conscientiousness; TIPI-ES = emotional stability; TIPI-O = openness to experience. * $p < .05$. ** $p < .01$. *** $p < .001$

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Table 3. *Hierarchical Multiple Regression Predicting Emotional Responding to Music*

Predictor	ΔR^2	β	*B*	*SE B*	95% CI for *B*
Step 1	.12***				
Age		-.34***	-1.26	.25	[-1.75, -.78]
Gender		-.10	-6.39	4.19	[-14.65, 1.87]
Step 2	.03				
Extraversion		.16*	1.64	.78	[.10, 3.18]
Conscientiousness		-.06	-.76	.91	[-2.56, 1.04]
Agreeableness		.12	1.65	1.02	[-.37, 3.67]
Openness		-.00	-.06	1.10	[-2.22, 2.11]
Stability		-.10	-1.12	.90	[-2.90, .66]
Step 3	.03*				
Affect Intensity		.20*	.61	.24	[.14, 1.08]
Step 4	.09***				
Empathy		.40***	.94	.20	[.55, 1.33]
Step 5	.03**				
Age		-.27***	-1.00	.25	[-1.48, -.52]
Gender		-.19**	-12.24	4.05	[-20.23, -4.25]
Extraversion		.21**	2.19	.79	[.64, 3.74]
Empathy		.39***	.92	.19	[.54, 1.30]
Alexithymia		.23**	.54	.18	[.19, .89]

Note. SE B = standard error of unstandardized coefficient; CI = confidence interval. Due to space considerations only the added variables are shown for steps 2-4, and only significant variables for step 5. * $p < .05$. ** $p < .01$. *** $p < .001$.

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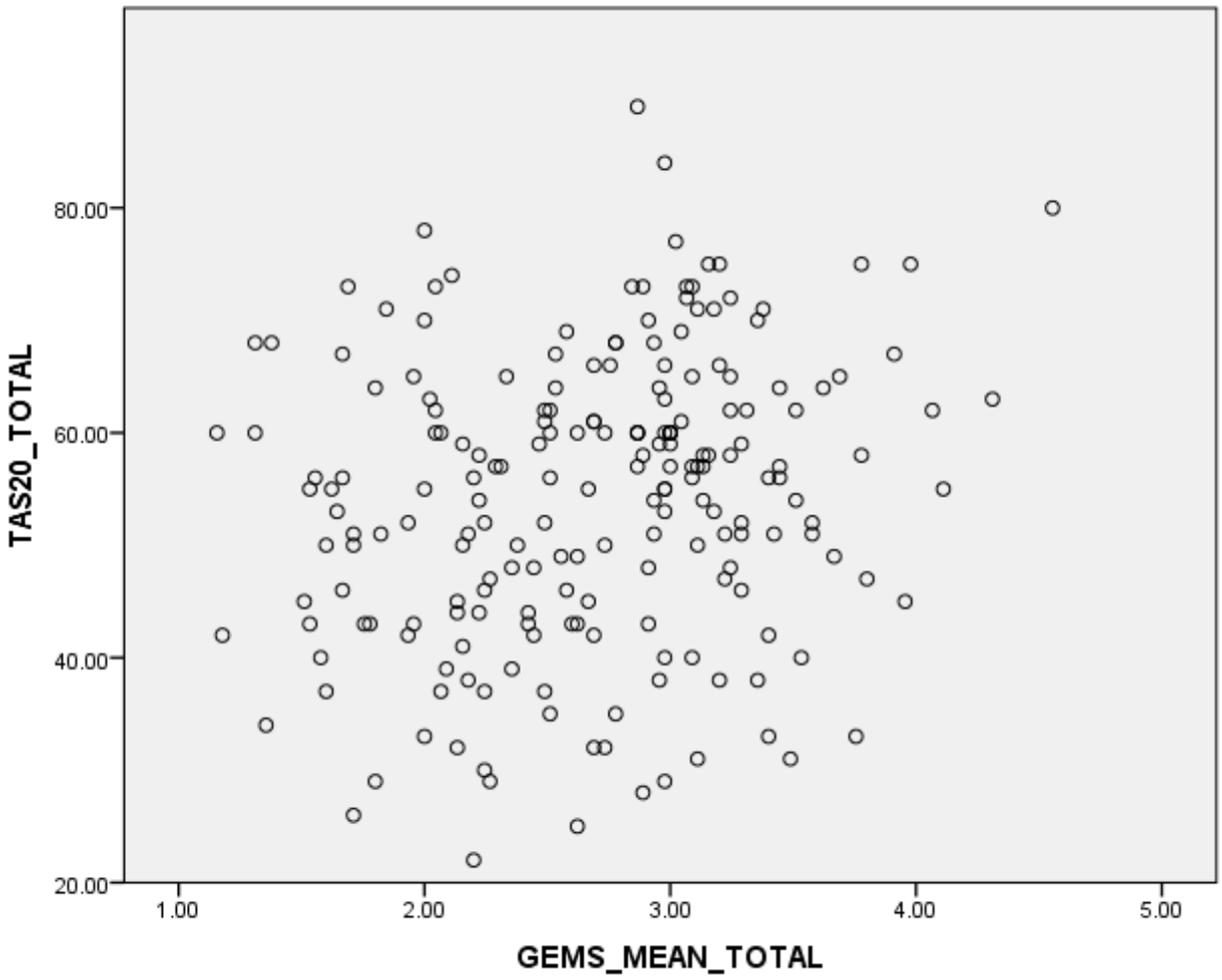
Figure 1. Scatterplot showing relationship between TAS-20 total alexithymia scores and GEMS mean scores on emotional responding to music.



Lyvers, M., Cotterell, S., & Thorberg, F. A. (2018). "Music is my drug": Alexithymia, empathy, and emotional responding to music. *Psychology of Music*. https://doi.org/10.1177/0305735618816166.